Resource Protection, Planning and Maintenance

Oil Spill Response.

Background.

With a major shipping lane located just six miles offshore, intensive commercial fishing activity as close as ten miles to the north, and major ports just across Cape Cod Bay, the probability of an oil spill impacting the resources of Cape Cod National Seashore is high; the presence of seven federally listed threatened and endangered species in CACO's offshore waters and seven more in the park's coastal areas, and the added presence of many large tankers, freighters, fishing and recreational vessels in the Gulf of Maine further confirm CACO's need for spill preparedness. There were at least thirteen major oil spills in the waters surrounding Cape Cod from 1969-1980 (Robinson, 1980) and several more in the late 1980s, two of which occurred in or near salt marshes. In addition, hundreds of small containers, many containing waste oil, wash onto CACO beaches every year. A Standard Operating Procedure for oil spills within the seashore was drafted in 1990, but a more detailed plan is needed for the evaluation and mitigation of spill impacts at CACO.

Research Needs.

An oil spill contingency and response plan needs to be developed in coordination with the United States Coast Guard. Oil spill booming priorities should be identified for park estuaries and beaches, with special consideration given to Nauset Marsh, the largest and least disturbed estuarine system within CACO and one with particular susceptibility to spills. A computer model of Nauset Marsh (developed by Friedrichs and Aubrey, 1989) may be useful for prescribing the locations and length of booms to best prevent resource damage in the estuary.

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Potential Contaminant Source Identification.

Background.

The thin lenses of fresh groundwater that make up the Cape Cod aquifer are the outer Cape's sole source of potable water and the only hydrologic resource for freshwater dependent flora and fauna within Cape Cod National Seashore. Because the sandy soils of the outer Cape are highly permeable, even a small spill of hazardous waste could easily penetrate the aquifer, with potentially drastic and lengthy effects on the area's water supply. In 1978, 3,000 gallons of gasoline leaked from an underground storage tank near the South Hollow Wellfield, the main source of water for Provincetown at the time. As a result of the leak, the wellfield became completely unusable for two years and provided only one-fourth of its former capacity for five more, not returning to full capacity until nine years after it was contaminated. More recently, cracked fuel storage tanks at a lower Cape gas station resulted in hydrocarbon and MTBE groundwater contamination, including that under National Park Service lands, and another local business dumped mercury-based fungicide on NPS property resulting in a $30,000 cleanup. A contaminant survey of CACO salt marshes additionally revealed elevated PCB levels in a Provincetown marsh that, historically, should have had no source for PCB contamination. Although contamination incidents on the lower Cape are not likely to approach the type of massive problem that exists around the closed Edwards Air Force Base on the upper Cape, where a plume of various contaminants is working its way towards a major population area with no alternative water sources, the decade-long repercussion from the relatively small Provincetown leak and the continuing impacts to CACO resources from contaminants originating outside park boundaries nonetheless demonstrate a strong need for risk assessment and spill preparedness within the seashore.

Research Needs.

Evaluate Potential Contamination Sources: Numerous potential sources of contamination exist on the outer Cape, both within and outside of the park boundaries, and an evaluation of their threat to CACO water resources is critically needed. Information on location, type and size of potential source areas should be entered into CACO's Geographic Information System; when coupled with hydrogeological modeling, this GIS data should provide a means for risk assessment based on quantity and proximity to water resources. Potential contaminant sources should additionally be prioritized in order to determine which sites present the greatest hazards.

Develop a CACO-Specific Emergency Response Plan: Emergency response plans for hazardous waste impacts to CACO resources and for providing emergency water in the event of a spill outside the park boundaries need to be developed. Specific policy decisions should be detailed for various scenarios, with the input and approval of CACO resource managers. Given the number of seasonal visitors to the seashore and the lower Cape, plans should be developed not only for known contaminant sources but also for accidental spills.

Septic Systems.

Background.

Nearly all of the homes and businesses on the outer Cape, including a number of seasonal and, increasingly, year-round residences on kettle pond shorelines within Cape Cod National Seashore, rely on septic systems for solid waste disposal. For over two decades, various reports have documented increases in nitrate and phosphorous concentrations in the groundwater on the outer Cape, directly linking the elevated levels with increases in housing density and the number of actively used on-site septic systems (including Frimpter and Gay, 1979; Persky, 1986; Noss, 1989; Goetz et al., 1991; Portnoy et al. 1998). The addition of nitrogen and phosphorous via contaminated groundwater discharge into Cape Cod's pond, estuary and salt marsh surface waters is a major management concern at CACO; increased algae production spurred by the input of these nutrients reduces water clarity and quality, deprives bottom-dwelling flora and fauna of sunlight and ultimately strips the water of oxygen, creating the potential for massive fish and shellfish kills due to anoxic conditions.

Title 5 (Massachusetts law 310 CMR 15, Requirements for the Disposal of Sanitary Sewage) regulates the siting, design and construction of on-site below-ground septic systems in Massachusetts, requiring that an inspection of the existing septic system be performed any time a property is sold, expanded or altered in its use. The regulation also requires that soil absorption systems maintain a 400-foot distance from surface drinking water supplies, a 100-foot separation from wells and a 50-foot distance from rivers, lakes, ponds and wetlands. Additionally, a 4-foot zone of unsaturated soil (5 feet in sandy soils) above the high groundwater level is mandated in order to allow for the removal of pathogenic biological pollutants before they reach the groundwater (Janik, 1987; Weiskel et al., 1996). Even when operating properly under ideal conditions, however, all conventional septic systems leach nitrogen into the groundwater. A minimum lot size of 40,000 square feet is needed to effectively dilute the nitrogen contribution of a single-family septic system to concentrations below the Barnstable County planning guideline of 5 mg/L (Veneman, unpublished). In areas where this minimum lot size is unfeasible, alternative septic technologies, such as recirculating sand filters, peat filters and the RUCK system, have shown potential for increased nitrogen removal; such technologies have yet to be significantly utilized, however, on the outer Cape.

The seasonal nature of population densities on Cape Cod provides an additional complication to the problem of nutrient loading from septic systems. Postma et al. (1992) reported that after a septic system operates for 8 to 15 months, the continuous supply of wastewater to a conventional system produces a biological clogging mat that slows the rate at which effluent travels into the soil, promoting an even distribution of effluent throughout the treatment field and enhancing the system's ability to filter pollutants. The seasonal use of a septic system prevents the formation of this clogging mat, leading to uneven effluent distribution and a subsequent reduction in the system's ability to efficiently remove pollutants. Furthermore, in the absence of a clogging mat, septic

Septic Systems, continued.

effluent travels largely undiluted through the sandy, porous soils of the outer Cape; this concentrated, localized effluent path receives little treatment before reaching groundwater.

Given the porous nature of Cape Cod's groundwater aquifer, the intensity of the recreation in, on and around CACO's kettle ponds and other surface water bodies and the inherent biological fragility of these water resources, protecting freshwater and brackish habitats from the impacts of on-site septic systems has become one of the most complicated and important management programs at CACO. With concerns for apparent eutrophication caused by human-induced nutrient loading, an intensive annual water quality monitoring program has been ongoing at CACO's kettle ponds for the last nine years. Research on alternative methods of wastewater disposal is still needed, however, to mitigate the impacts of septic effluent on CACO water resources and to develop a sustainable balance between an increasing human presence and healthy groundwater on the outer Cape.

Research Needs.

Review Alternative Methods of Wastewater Disposal: As an initial step towards reducing septic system impacts on CACO's water resources, a literature review of potential alternative methods for wastewater disposal on the outer Cape needs to be conducted. Specific areas of investigation should include alternative technologies for private septic systems, cluster or package treatment plants for selected areas and increased on-line sewage, with information on cost, maintenance requirements, effectiveness, conditions for use (seasonal vs. year-round) and user reaction compiled for each. The feasibility of developing alternative septic technology for CACO facilities should also be evaluated, in part by comparing the available information on alternative technologies to facility requirements within the park.

Develop Case Studies of Improved or Alternative Septic Systems: Once the above literature review has been completed, at least two case model studies should be developed to demonstrate and evaluate appropriate systems for wastewater disposal within CACO. Ideally, one of these would be seasonally occupied, the other year-round, and both in close proximity to a kettle pond. Information then needs to be collected on actual installation costs, maintenance requirements, treatment efficacy and user reaction to the new technologies. Changes in nutrient transport resulting from use of the new system should be determined through the installation and monthly sampling of several shallow wells with 1 to 5-foot screened intervals, both before and for at least one year after the new system is installed.

(See related project descriptions under "Kettle Ponds," in the Aquatic Ecology chapter.)

Septic Systems, continued.

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Water Efficiency in Park Facilities.

Background.

Cape Cod National Seashore has three types of properties within its boundaries: park-owned facilities that are operated and/or used by park staff and the general public, federally-owned homes that are privately occupied, and grandfathered private properties that will always exist in CACO, but will never fall under the ownership of the National Park Service unless donated or sold to the park. Though use and ownership issues differ among the approximately 700 improved properties within the seashore, all have a potential impact on CACO's aquatic resources. Nearly all of the homes and businesses on the outer Cape, including a number of seasonal and, increasingly, year-round residences on kettle pond shorelines within the seashore, rely on septic systems for solid waste disposal. The addition of nitrogen and phosphorous via contaminated groundwater discharge from septic systems into Cape Cod's pond, estuary and salt marsh surface waters is a major management concern at CACO; increased algae production spurred by the input of these nutrients reduces water clarity and quality, deprives bottom-dwelling flora and fauna of sunlight and ultimately strips the water of oxygen, creating the potential for massive fish and shellfish kills due to anoxic conditions.

Quantity, as well as quality, of the outer Cape's fresh groundwater is also a concern. The thin lenses of fresh groundwater that make up the Cape Cod aquifer are the outer Cape's sole source of potable water and the only hydrologic resource for freshwater dependent flora and fauna within the seashore. The only source of freshwater to these lenses is precipitation; excessive water use during a dry year could thus damage plant and animal communities in wetlands and along pond shorelines.

Water conservation has occurred within the park to some degree. Low-flow showerheads have been installed in all of the houses that are owned and occupied by NPS staff, and low-flush toilets have been placed in some of the seasonal homes. On a more public scale, CACO has worked collaboratively with the Town of Provincetown to educate residents and visitors about water conservation. Water conservation strategies still need to be implemented more vigorously throughout the park, however, not only to minimize park impacts to resources, but also to serve as a working model of water conservation techniques for the park's many visitors and residents.

Research Needs.

Update Infrastructure Inventory: The existing inventory of water- and wastewater-related structures within the park, including underground storage tanks, needs to be updated to eliminate incorrect, incomplete or missing information. Since all improved properties have the potential to impact water resources, all improved properties within the park's boundaries should be inventoried, regardless of ownership status. Information relevant to a water resource risk assessment should be gathered for each

Water Efficiency in Park Facilities, continued.

structure, and the location of each facility or house should be recorded in a parkwide Geographic Information System data layer.

(See related projects under "Potential Contaminant Source Identification" and, in the Natural Resource Management chapter, "Land Use Mapping.")

Monitor Water Efficiency: Flow meters need to be installed in each CACO facility, and research conducted to evaluate the effects of different plumbing hardware and behavioral approaches to water conservation.

Assess Risk to Water Resources: Based on the information gathered in the above projects, an assessment of the risk to CACO water resources from existing infrastructure and housing needs to be developed. Water resource-based criteria should be developed for the management of CACO homes and facilities, and appropriate strategies should be recommended for encouraging similar water-conscious management of private in-holdings.

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